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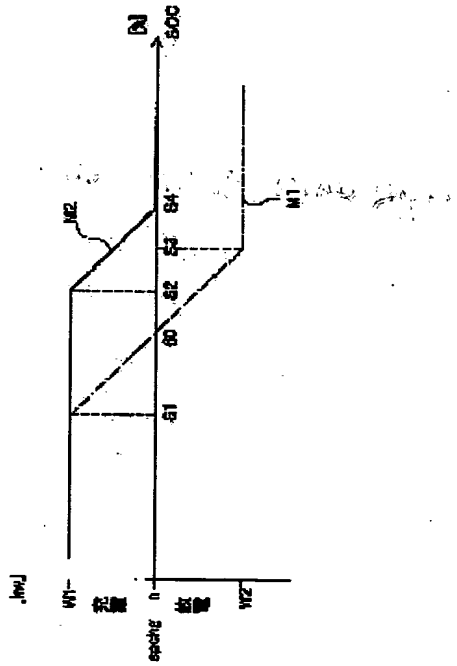
(54) HYBRID VEHICLE AND METHOD FOR CONTROLLING ENGINE USED THEREIN

(57)Abstract:
PROBLEM TO BE SOLVED: To warm up catalyst for purifying exhaust gas without deteriorating fuel consumption.
SOLUTION: When the warm-up of catalyst is required, a map M2 for warm-up demand is used as a charge and discharge correction value calculation map for deriving a charge and discharge correction value spchg from a battery 194, and accordingly, a demand power for an engine is set to be higher than a normal power. Thus, when the catalyst is warmed up, a power higher than the normal power can be taken out from the engine, and the volume of exhaust gas from the engine can be appropriately ensured thereby it is possible to optimumly warm up the catalyst. Further, even though a higher power is taken out from the engine, the power is converted into an electric power by a generator so as to sufficiently charge the battery, thereby it is possible to prevent the fuel consumption from being deteriorated.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The engine which outputs power, and the generator which can be generated using a part of power [at least] which this engine outputted, The motor operated so that the power outputted to a driving shaft may turn into desired power using the power which discharged from the rechargeable battery which charges a part of generated power [at least], and the power generated with said generator or said rechargeable battery, The catalyst for purifying the exhaust gas which is formed in the flueway of said engine and passes along this flueway, A charge detection means to be the hybrid car which drives a wheel and to detect the charge of said rechargeable battery with the power outputted to a preparation and said driving shaft, So that it may become almost equal to a demand power setting means to set up the demand power to said engine, and said demand power, with which the power outputted from said engine was set up based on the predetermined parameter containing said detected charge It has the engine control means which can control said engine. Said demand power derivation means The hybrid car more nearly usually than the time characterized by setting up much power as said demand power when said detected charge is in the predetermined range and there is a warming-up demand for the temperature rise of said catalyst.
[Claim 2] When said engine control means adjusts the opening of the throttle valve of said engine in a hybrid car according to claim 1, it is the hybrid car characterized by making it the power outputted from said engine become almost equal to said demand power.
[Claim 3] It is the hybrid car characterized by advancing the warming-up demand for the temperature rise of said catalyst to said demand power derivation means when this temperature that said engine control means presumed the temperature of said catalyst from the predetermined parameter relevant to said engine in the hybrid car according to claim 1 or 2, and was presumed is below predetermined temperature.
[Claim 4] The engine which outputs power, and the generator which can be generated using a part of power [at least] which this engine outputted, The motor operated so that the power outputted to a driving shaft may turn into desired power using the power which discharged from the rechargeable battery which charges a part of generated power [at least], and the power generated with said generator or said rechargeable battery, The catalyst for purifying the exhaust gas which is formed in the flueway of said engine and passes along this flueway, The process which is the control approach of said engine used in the hybrid car which drives a wheel, and detects the charge of the (a) aforementioned rechargeable battery with the power outputted to a preparation and said driving shaft, (b) So that it may become almost equal to said demand power with which the process which sets up the demand power to said engine, and the power outputted from the (c) aforementioned engine were set up based on the predetermined parameter containing said detected charge It has the process which controls said engine. Said process (b) The control approach of the engine more nearly usually than the time characterized by including the process which sets up much power as said demand power when there is said warming-up demand and said detected charge is [the process which judges whether it is no with the warming-up demand for the temperature rise of said catalyst, and] in the predetermined range.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] The engine with which this invention outputs power, and the generator which can be generated using the power with which the engine outputted, The motor operated so that the rechargeable battery which charges the generated power, and the power outputted to a driving shaft using the power which generated electricity or discharged may turn into desired power, It is related with the control approach of the engine used in the hybrid car and it which can perform warming up of the catalyst for purifying the exhaust gas from an engine, without worsening fuel consumption especially about a ******** hybrid car.
[0002]
[Description of the Prior Art] In recent years, the so-called configuration of a hybrid car is variously proposed for the purpose of coexistence with the fast improvement in the fuel consumption of engines, such as a gasoline recipro engine which outputs power by combustion of a fuel, or the emission-gas-purification engine performance, and reservation of the performance-traverse ability of a car. The series hybrid method which it will generate electricity by driving a generator with an engine if a hybrid car is roughly divided, and drives a motor with the generated power, and obtains the driving force of a car, and the parallel hybrid system which combines an engine and a motor with a driving shaft, respectively, and obtains the driving force of a car with an engine and a motor are known. By any method, since the power outputted from the engine can be outputted to a driving shaft with the engine speed and torque of arbitration, an engine can choose the operating point when operation effectiveness is high, and can be operated. Moreover, since an engine can be stopped even if it is under transit by obtaining driving force with a motor, on-off operation of the engine can be carried out, and it can be made to run a car. Therefore, the hybrid car is excellent in saving-resources nature and exhaust air purification nature compared with the conventional car which makes only an engine a driving source.
[0003] By the car of a parallel hybrid system, a part of power outputted from the engine is transmitted to a driving shaft by the power-adjusting device among these methods. Residual power is changed into power by the power adjusting device. A dc-battery stores electricity this power, or it is used for driving the motor as sources of power other than an engine.
[0004] The machine distribution mold power adjusting device using the planetary gear which have three shafts combined with the motor generator which has a revolving shaft, and a driving shaft, an engine output shaft and the revolving shaft of a motor generator as a power adjusting device, respectively, for example, the electric distribution mold power adjusting device using the motor for Rota equipped with Rota combined with the engine output shaft and Rota combined with the driving shaft, etc. are applicable.
[0005] In the motor for Rota, residual power can be taken out as power, transmitting mechanical power to Rota of another side from one Rota by controlling the rotational frequency difference between [of two] Rota, i.e., slippage, as already known. Moreover, it can also transmit to Rota of another side by supplying power, making mechanical power increase. Moreover, as everyone knows, planetary gear have the property in which the residual rotational frequency and the torque of a revolving shaft are decided, if a biaxial rotational frequency and torque are decided

among three shafts. Residual power can be taken out as power with the motor generator combined with the revolving shaft which remains, outputting a part of mechanical power inputted from the revolving shaft combined with the output shaft of engine ** to a driving shaft based on this property. Moreover, it is also possible by supplying power to this motor generator to increase and to transmit the power outputted from the engine to a driving shaft.
[0006] As explained above, since the operating point when operation effectiveness is high is chosen, an engine can be operated and it is possible to carry out on-off operation of the engine, and to make it run a car, it excels in the hybrid car at saving-resources nature and exhaust air purification nature.
[0007] However, also in the hybrid car, in order to purify the exhaust gas discharged from an engine as well as the usual car since the exhaust gas discharged from an engine cannot be made into zero as long as an engine is used, the exhaust emission control device equipped with the catalyst is prepared in the engine flueway.
[0008] Generally, if the temperature of the catalyst in an exhaust emission control device is low, it cannot be activated and cannot demonstrate the function as a catalyst enough. Therefore, in order to raise the temperature of a catalyst at the time of starting of an engine, it is necessary to perform warming up of a catalyst.
[0009] Then, in the former, after surely starting an engine by start switching off a hybrid car, in order to raise the temperature of the catalyst in an exhaust emission control device, control (henceforth ignition lag control) which carries out the lag of the ignition timing from the usual ignition timing was performed to the engine. This is carrying out the lag of the ignition timing, it delays a combustion stage, burns an exhaust air line also in inside, and promotes the temperature rise of the catalyst in an exhaust emission control device.
[0010]
[Problem(s) to be Solved by the Invention] However, since an engine will surely be started when a start switch is turned on if it does in this way, an engine will operate during a halt of a hybrid car and it becomes disadvantageous in respect of fuel consumption.
[0011] Then, although what is necessary is making it just not start an engine in order to hold down fuel consumption when a start switch's is turned on, in case an engine carries out on-off operation during car transit shortly, how warming up of a catalyst is performed poses a problem.
[0012] For example, since it is the control which worsens the fuel consumption of the ignition lag control itself and an engine when the ignition lag control to an engine tends to perform warming up of a catalyst similarly with having described above during car transit, it becomes disadvantageous in respect of fuel consumption also in this case.
[0013] Therefore, the purpose of this invention is to offer the hybrid car which can perform warming up of the catalyst for purifying exhaust gas, without solving the trouble of the above-mentioned conventional technique and worsening fuel consumption.
[0014]
[The means for solving a technical problem, and its operation and effectiveness] In order to attain a part of above-mentioned purpose [at least], the hybrid car of this invention The engine which outputs power, and the generator which can be generated using a part of power [at least] which this engine outputted, The motor operated so that the power outputted to a driving shaft may turn into desired power using the power which discharged from the rechargeable battery which charges a part of generated power [at least], and the power generated with said generator or said rechargeable battery, The catalyst for purifying the exhaust gas which is formed in the flueway of said engine and passes along this flueway, A charge detection means to be the hybrid car which drives a wheel and to detect the charge of said rechargeable battery with the power outputted to a preparation and said driving shaft, So that it may become almost equal to a demand power setting means to set up the demand power to said engine, and said demand power, with which the power outputted from said engine was set up based on the predetermined parameter containing said detected charge It has the engine control means which can control said engine. Said demand power derivation means When said detected charge is in the predetermined range and there is a warming-up demand for the temperature rise of said catalyst, more nearly usually than the time let it be a summary to set up much power as said

demand power.
[0015] Moreover, the engine with which the control approach of the engine of this invention outputs power, The generator which can be generated using a part of power [at least] which this engine outputted, The motor operated so that the power outputted to a driving shaft may turn into desired power using the power which discharged from the rechargeable battery which charges a part of generated power [at least], and the power generated with said generator or said rechargeable battery, The catalyst for purifying the exhaust gas which is formed in the flueway of said engine and passes along this flueway, The process which is the control approach of said engine used in the hybrid car which drives a wheel, and detects the charge of the (a) aforementioned rechargeable battery with the power outputted to a preparation and said driving shaft, (b) So that it may become almost equal to said demand power with which the process which sets up the demand power to said engine, and the power outputted from the (c) aforementioned engine were set up based on the predetermined parameter containing said detected charge It has the process which controls said engine. Said process (b) When the process which judges whether it is no with the warming-up demand for the temperature rise of said catalyst, and said charge detected when there was said warming-up demand are in the predetermined range, more nearly usually than the time let it be a summary to include the process which sets up much power as said demand power.
[0016] Thus, the charge of a rechargeable battery is detected, and when the charge is in the predetermined range and there is a warming-up demand for the temperature rise of a catalyst, he is trying to usually set up much power as demand power to an engine rather than the time by the hybrid car or the engine control approach of this invention.
[0017] Therefore, since according to the hybrid car or the engine control approach of this invention much power will usually be outputted rather than the time from an engine when there is a warming-up demand for the temperature rise of a catalyst, the amount of the exhaust gas discharged from an engine is moderately securable. Consequently, since the temperature of the catalyst prepared in the engine flueway can fully be raised with the exhaust gas warmed moderately, warming up of the optimal catalyst can be performed. Moreover, even if much power is outputted from an engine, since the power is changed into power by the generator and can fully charge a rechargeable battery with it, it can prevent aggravation of fuel consumption.
[0018] Moreover, as for said engine control means, in the hybrid car of this invention, it is desirable by adjusting the opening of the throttle valve of said engine to make it the power outputted from said engine become almost equal to said demand power.
[0019] Thus, when are constituted and there is a warming-up demand for the temperature rise of a catalyst, the opening of an engine throttle valve is adjusted, and since it will be controlled so that much power is outputted from an engine, fuel consumption can be raised as compared with the case where the above-mentioned ignition lag control is performed.
[0020] Moreover, as for said engine control means, in the hybrid car of this invention, it is desirable to advance the warming-up demand for the temperature rise of said catalyst from the predetermined parameter relevant to said engine to said demand power derivation means, when this temperature that presumed the temperature of said catalyst and was presumed is below predetermined temperature.
[0021] Thus, by constituting, the temperature of a catalyst is low, and when the function as a catalyst cannot demonstrate enough, a warming-up demand can be advanced appropriately.
[0022]
[Embodiment of the Invention] (1) Use and explain drawing 1 about the configuration of one example of this invention at the beginning of the configuration of an example. Drawing 1 is the block diagram showing the outline configuration of the hybrid car as one example of this invention.
[0023] the power network which the configuration of this hybrid car is large and generates driving force, its control network, and the power transfer network which transmits the driving force from a driving source to driving wheels 116 and 118 -- since -- it has become.
[0024] The above-mentioned power network consists of a network containing an engine 150, and a network containing motors MG1 and MG2. Moreover, a control network The engine control unit

170 for mainly controlling operation of an engine 150 (hereafter referred to as ENGECU). It consists of an HV control unit (hereafter referred to as HVECU) 190 which mainly controls operation of motors MG1 and MG2, and the various sensor sections which detect, output and input a signal required for ENGECU170 and HVECU190.

[0025] In addition, although the internal configuration of ENGECU170 and HVECU190 is not specifically illustrated, these are each one-chip microcomputers which have CPU, ROM, RAM, etc. inside, and they are constituted so that various control processings shown below may be performed according to the program to which CPU was recorded on ROM.

[0026] Control by ENGECU170 and HVECU190 receives the power from an engine 150, and, below, the configuration which outputs further the power adjusted by the power of motors MG1 and MG2 or generation of electrical energy to a driving shaft 112 to the power of this engine 150 by planetary gear 120 is called the power output unit 110.

[0027] From a fuel injection valve 151, a gasoline is injected and the engine 150 in the power output unit 110 generates gaseous mixture with the inhaled air and the injected gasoline while inhaling air from the inhalation opening 200 through a throttle valve 261. At this time, the closing motion drive of the throttle valve 261 is carried out by the actuator 262. An engine 150 inhales the generated gaseous mixture to a combustion chamber 152 through an inlet valve 153, and changes into rotation of a crankshaft 156 movement of the piston 154 depressed by explosion of this gaseous mixture. This explosion is produced from an ignitor 158 by gaseous mixture being lit by the spark which the ignition plug 162 formed with the high voltage drawn through the distributor 160, and burning by it.

[0028] The exhaust gas (exhaust air) produced by combustion passes along an exhaust pipe 202, and flows into the exhaust emission control device 204 with which the exhaust pipe 202 was equipped. In the exhaust emission control device 204, it has the catalyst 206 for purifying exhaust gas. This catalyst 206 consists of three way component catalysts which purify the hydrocarbon for example, in exhaust gas, a carbon monoxide, nitrogen oxide, nitrogen oxide, etc., and is activated at the high rate of purification within the limits of beyond predetermined temperature. Therefore, the exhaust gas which flowed into the exhaust emission control device 204 is purified by the exhaust emission control device 204, and is discharged in atmospheric air after that.

[0029] Moreover, an engine 150 is equipped with the device in which the closing motion timing of an inlet valve 153 is changed, and the so-called continuation adjustable valve timing device (henceforth VVT) 157. This VVT157 adjusts the closing motion timing of an inlet valve 153 for the phase to the crank angle of the inhalation-of-air cam shaft (not shown) which carries out the closing motion drive of the inlet valve 153 a tooth lead angle or by carrying out a lag.

[0030] On the other hand, operation of an engine 150 is controlled by ENGECU170. For example, based on the detecting signal obtained by the throttle-valve position sensor 263 which detects the opening (position), feedback control of the throttle valve 261 is carried out so that it may become desired opening using an actuator 262 by ENGECU170. Moreover, feedback control is made as the tooth lead angle and lag of a phase of an inhalation-of-air cam shaft in above-mentioned VVT157 also serve as a target phase by ENGECU170 based on the detecting signal obtained by the cam-shaft position sensor 264 which detects the position of an inhalation-of-air cam shaft. Others have ignition timing control of the ignition plug 162 according to the rotational frequency of an engine 150, the fuel-oil-consumption control according to an inhalation air content, etc.

[0031] Moreover, in order to enable such control of an engine 150, various sensors and switches in which the operational status of an engine 150 other than the above-mentioned throttle-valve position sensor 263 or the cam-shaft position sensor 264 is shown are connected to ENGECU170. For example, the start switch 179 which detects the coolant temperature sensor 174 which detects the temperature of the cooling water for cooling an engine 150, and the condition of an ignition key, the engine-speed sensor 176, the angle-of-rotation sensor 178 prepared for the distributor 160 in order to detect the engine speed and angle of rotation of a crankshaft 156, etc. are connected. In addition, illustration of other sensors, a switch, etc. was omitted.

[0032] Next, the outline configuration of the motors MG1 and MG2 shown in drawing 1 is explained. A motor MG 1 is constituted as a synchronous motor generator, and is equipped with Rota 132 which has two or more permanent magnets in a peripheral face, and the stator 133 around which the three phase coil which forms rotating magnetic field was wound. The stator 133 is being fixed to the case 119. This motor MG 1 operates as a motor which carries out the rotation drive of Rota 132 by the interaction of the field by the permanent magnet with which Rota 132 was equipped, and the field formed with the three phase coil with which the stator 133 was equipped, and operates also as a generator which makes the both ends of the three phase coil with which the stator 133 was equipped by these interactions depending on the case produce electromotive force.
[0033] A motor MG 2 is constituted as a synchronous motor generator like a motor MG 1, and is equipped with Rota 142 which has two or more permanent magnets in a peripheral face, and the stator 143 around which the three phase coil which forms rotating magnetic field was wound. The stator 143 of a motor MG 2 is also being fixed to the case 119. It operates as a motor or a generator like [this motor MG 2] a motor MG 1.
[0034] These motors MG1 and MG2 are electrically connected to a dc-battery 194 and HVECU190 through the 1st and 2nd drive circuits 191,192. From HVECU190, the control signal which drives the 1st and 2nd drive circuits 191,192 is outputted. Each drive circuit 191,192 constitutes the inverter and makes the current which flows to each phase of a three phase coil the false sine wave by PWM control based on the control signal from HVECU190. Consequently, rotating magnetic field are formed with a three phase coil, and motors MG1 and MG2 drive.
[0035] In order to enable control of the operational status of a hybrid car including control of motors MG1 and MG2, in addition to this, various kinds of sensors and switches are electrically connected to HVECU190. As the sensor connected to HVECU190, and a switch, there are accelerator pedal position sensor 164a, the charge detector 199 of a dc-battery 194, an air-conditioner sensor 165, etc., for example.
[0036] An accelerator pedal position (namely, the amount of treading in of an accelerator pedal 164) is acquired from accelerator pedal position sensor 164a among these. Moreover, the charge (SOC) of a dc-battery 194 is acquired from the charge detector 199. ON/OFF state of an air-conditioner (not shown) are acquired from the air-conditioner sensor 165.
[0037] Thus, HVECU190 inputs the various detection results of these sensors and switches as a signal, and also is exchanging the information various between ENGECU(s)170 which control an engine 150, by communication link.
[0038] On the other hand, the configuration of the power transfer network which transmits the driving force from a driving source to driving wheels 116 and 118 is as follows. The crankshaft 156 for transmitting the power of an engine 150 is combined with the planetary carrier shaft 127 through a damper 130, and this planetary carrier shaft 127, and the sun gear shaft 125 which transmits rotation of a motor MG 1 and a motor MG 2 and the ring wheel shaft 126 are mechanically combined with the planetary gear 120 mentioned later.
[0039] The power fetch gear 128 for power ejection is combined with the ring wheel 122 in the location between a ring wheel 122 and a motor MG 1. This power fetch gear 128 is connected to the power receipt gear 113 by the chain belt 129, and transfer of power is made between the power fetch gear 128 and the power receipt gear 113. It is combined with the power transfer gear 111 through the driving shaft 112, and this power transfer gear 111 is further combined with the driving wheels 116 and 118 on either side through the differential gear 114, and this power receipt gear 113 can transmit power now to these.
[0040] Planetary gear 120 consist of three of two or more planetary pinion gears 123 which revolve around the sun while it is arranged between a sun gear 121, two gears of the same axle which consist of ring wheels 122, and sun gears 121 and ring wheels 122 and the periphery of a sun gear 121 is rotated. A sun gear 121 is combined with Rota 132 of a motor MG 1 through the sun gear shaft 125 of the hollow which penetrated the shaft center on the planetary carrier shaft 127, and the ring wheel 122 is combined with Rota 142 of a motor MG 2 through the ring wheel shaft 126. Moreover, the planetary pinion gear 123 is combined with the planetary carrier shaft 127 through the planetary carrier 124 which supports the revolving shaft to revolve, and the

planetary carrier shaft 127 is combined with the crankshaft 156. Although it is the thing of common knowledge on device study, planetary gear 120 have the property in which the torque outputted and inputted by the rotational frequency of one residual shaft and its revolving shaft is determined, if the torque outputted and inputted by the rotational frequencies of any 2 shafts and these shafts among 3 of the above-mentioned sun gear shaft 125, the ring wheel shaft 126, and the planetary carrier shaft 127 shafts is determined.

[0041] (2) Explain briefly general actuation, next general actuation of the hybrid car shown in drawing 1 . The hybrid car which has the configuration mentioned above outputs the power equivalent to the demand power which should be outputted to a driving shaft 112 at the time of transit from an engine 150, carries out torque conversion of the outputted power as follows, and is transmitting it to the driving shaft 112. When the crankshaft 156 of an engine 150 is rotating with a high engine speed and low torque to the demand engine speed and demand torque which should be outputted from a driving shaft 112, torque conversion collects as power a part of power which is outputting the engine 150 by the motor MG 1, and drives a motor MG 2 with the power.

[0042] Specifically, the power first outputted from the engine 150 is distributed to the power transmitted to the motor MG 1 combined with the sun gear shaft 125 in planetary gear 120, and the power transmitted to a driving shaft 112 through the ring wheel shaft 126. These power distribution are performed under conditions whose rotational frequency of the ring wheel shaft 126 corresponds with a demand rotational frequency. The power transmitted to the sun gear shaft 125 is revived as power by the motor MG 1. Torque is added to the ring wheel shaft 126 by on the other hand driving the motor MG 2 combined with the ring wheel shaft 126 using this power. This torque addition is performed so that demand torque may be outputted to a driving shaft 112. In this way, by adjusting the power exchanged in the form of power through motors MG1 and MG2, the power outputted from the engine 150 can be outputted from the driving shaft 112 as a desired rotational frequency and torque.

[0043] On the contrary, when the crankshaft 156 of an engine 150 is rotating with a low engine speed and high torque to the demand engine speed and demand torque which should be outputted from a driving shaft 112, a motor MG 2 recovers power for a part of power which is outputting the engine 150, and a motor MG 1 is driven with the power.

[0044] In addition, a part of power collected by motors MG1 or MG2 can be accumulated in a dc-battery 194. Moreover, it is also possible to drive motors MG1 or MG2 using the power accumulated in the dc-battery 194.

[0045] The power of a motor MG 2 also uses and runs, making an engine 150 into the main driving source based on this principle of operation at the time of stationary transit. Thus, since an engine 150 can be operated in the operating point when operation effectiveness is high according to the torque which may be generated by required torque and required Motor MG 2 by running the both sides of an engine 150 and a motor MG 2 as a driving source, compared with the car which makes only an engine 150 a driving source, it excels in saving-resources nature and exhaust air purification nature. It is also possible to run on the other hand, generating electricity by the motor MG 1 by operation of an engine 150, since rotation of a crankshaft 156 can be transmitted to a motor MG 1 through the planetary carrier shaft 127 and the sun gear shaft 125.

[0046] In addition, the following relation is known by the rotational frequency of the planetary gear 120 used in the above-mentioned torque conversion. That is, generally the relation of a degree type (1) is materialized about planetary gear 120 between rho then the rotational frequency Ns of the sun gear shaft 125, the rotational frequency Nc of the planetary carrier shaft 127, and the rotational frequency Nr of the ring wheel shaft 126 in the gear ratio (number of teeth of the number of teeth/ring wheel of a sun gear) of a sun gear 121 and a ring wheel 122. In the case of this example, the rotational frequency Ns of the sun gear shaft 125 is a parameter equivalent to the rotational frequency ng of a motor MG 1, the rotational frequencies Nr of the ring wheel shaft 126 are the vehicle speed and a parameter equivalent to several nm rotation of a motor MG 2, and the rotational frequency Nc of the planetary carrier shaft 127 is a parameter equivalent to the rotational frequency ne of an engine 150.

[0047]
Ns=Nc+(Nc-Nr)/rho ... (1)
[0048] (3) Explain control processing of the engine 150 in connection with catalyst warming up, next control processing of the engine 150 in connection with warming up of the catalyst in this example using drawing 2 and drawing 3 .
[0049] Drawing 2 is a flow chart which shows the flow of the control manipulation routine by ENGECU170 among the control processings in connection with catalyst warming up, and drawing 3 is a flow chart which similarly shows the flow of the control manipulation routine by HVECU190. That is, the routine shown in drawing 2 is processing performed by CPU (not shown) of ENGECU170, and the routine shown in drawing 3 is processing similarly performed by CPU (not shown) of HVECU190. In addition, these control manipulation routines are repeatedly performed by each with a predetermined time interval.
[0050] If the control manipulation routine shown in drawing 2 is started, ENGECU170 will acquire the temperature of the cooling water for cooling an engine 150 from a coolant temperature sensor 174 first (step S102). And from the water temperature of the acquired cooling water, ENGECU170 presumes the temperature of the catalyst 206 for emission gas purification arranged in the exhaust emission control device 204, and computes it as estimate T whenever [catalyst temperature] (step S104).
[0051] In addition, although the temperature of a catalyst 206 is presumed from the water temperature of an engine cooling water in this way, a sensor is formed in the interior of an exhaust emission control device 204 whenever [catalyst temperature], and you may make it search for the temperature of a catalyst 206 directly in this example.
[0052] Next, HVECU190 determines whether it is necessary to perform warming up, in order that Estimate T may judge whether it is below the predetermined threshold Tb set up beforehand (step S106) and may raise the temperature of a catalyst 206 whenever [catalyst temperature / which was computed].
[0053] Here, the value corresponding to whenever [catalyst temperature / which a catalyst 206 is activated and can fully demonstrate the function of emission gas purification as a threshold Tb] is set up.
[0054] HVECU190 sets a warming-up demand flag to ENGECU170 noting that the temperature of a catalyst 206 needs to perform warming up of a catalyst 206 low, when Estimate T is below the threshold Tb whenever [catalyst temperature] as a result of a judgment (step S108). On the contrary, when the warming-up demand flag is already set noting that the temperature of a catalyst 206 does not need to perform warming up of a catalyst 206 sufficiently highly, when larger than a threshold Tb, HVECU190 clears the warming-up demand flag (step S110). Here, explanation of drawing 2 is once interrupted on account of explanation, and it moves to explanation of drawing 3 .
[0055] On the other hand, if the control manipulation routine shown in drawing 3 is started, HVECU190 will acquire the vehicle speed of a hybrid car from the sensor (not shown) which detects the rotational frequency Nr of the ring wheel shaft 126 first, will acquire the amount of treading in of an accelerator pedal 164 from accelerator pedal position sensor 164a, and will acquire ON/OFF state of an air-conditioner from the air-conditioner sensor 165 (step S202). And HVECU190 acquires the charge (SOC) of a dc-battery 194 from the charge detector 199 further (step S204).
[0056] Next, ENGECU170 performs processing of step S212, after performing processing of step S206 and steps S208 or S210. In addition, the back explains step S206 thru/or processing of S210 in more detail.
[0057] At step S212, ENGECU170 computes the base demand power spv to an engine 150 according to the following formula (2) based on the vehicle speed acquired at step S202, the amount of treading in of an accelerator pedal 164, ON/OFF state of an air-conditioner, the charge of the dc-battery 194 acquired at step S204, etc.
[0058]
spv=spacc+spac+spchg -- (2)
[0059] Here, spacc expresses required basic demand power (value converted into the amount of

generations of electrical energy), when providing all the driving torque for making it run a hybrid car with an engine 150. HVECU190 draws the basic demand power spacc based on the vehicle speed and the amount of treading in of an accelerator pedal 164 which were acquired. The basic demand power calculation map which makes a parameter the vehicle speed and the amount of treading in of an accelerator pedal 164 is specifically beforehand memorized in ROM (not shown) in the interior of HVECU190, and he is trying for HVECU190 to ask for the basic demand power spacc from this map about the vehicle speed and the amount of treading in of an accelerator pedal 164 which were acquired.

[0060] Moreover, spac expresses the amount of amendments in case an air-conditioner drives. Since the consumption of power is large, an air-conditioner amends the power used apart from other auxiliary machinery. When recognizing and driving whether the air-conditioner is driving HVECU190 based on ON/OFF state of the acquired air-conditioner, a part for the power consumption of an air-conditioner is drawn as this amount spac of amendments. In addition, in this example, although the air-conditioner sensor 165 has detected ON/OFF state of an air-conditioner, if there is a function in which the air-conditioner sensor 165 detects transition of the power consumption of not only ON/OFF state of an air-conditioner but an air-conditioner etc., this amount spac of air-conditioner amendments can be drawn more correctly.

[0061] Moreover, spchg expresses the amount of charge-and-discharge amendments from a dc-battery 194. HVECU190 draws this amount spchg of charge-and-discharge amendments based on the charge (SOC) of the acquired dc-battery 194. Generally, since the charge demand of a dc-battery 194 is high when the charge of a dc-battery 194 is low, the amount spchg of charge-and-discharge amendments becomes high (just becoming), and since the discharge demand of a dc-battery 194 is high conversely when a charge is high, the amount spchg of charge-and-discharge amendments becomes low (it becomes negative). Usually, when a charge is about 60 [%] so that it may mention later, the demand of the charge and discharge of a dc-battery 194 is lost, and, sometimes, the amount spchg of charge-and-discharge amendments is set to 0. In addition, the amount calculation map of charge-and-discharge amendments which makes the charge of a dc-battery 194 a parameter is memorized in ROM (not shown) in the interior of HVECU190, and he is trying for HVECU190 to calculate the amount spchg of charge-and-discharge amendments from this map about the charge of the acquired dc-battery 194 beforehand similarly [in the amount spchg of charge-and-discharge amendments / of the above-mentioned basic demand power spacc].

[0062] Then, HVECU190 adds the basic demand power spacc drawn as mentioned above, the amount spac of air-conditioner amendments, and the amount spchg of charge-and-discharge amendments from a dc-battery 194, respectively, as shown in a formula (2), and it draws the base demand power spv to an engine 150.

[0063] By the way, in this example, two kinds of maps, the map for the time and the map for pre-heating demands, are usually prepared as an amount calculation map of charge-and-discharge amendments used in case the amount spchg of charge-and-discharge amendments from a dc-battery 194 is drawn.

[0064] Drawing 4 is the explanatory view showing the amount calculation map of charge-and-discharge amendments used in this example. In drawing 4 , an axis of abscissa expresses the charge (SOC) of a dc-battery 194, and the axis of ordinate expresses the amount spchg of charge-and-discharge amendments. Moreover, the map M1 shown with the alternate long and short dash line is a map usually used sometimes, and the map M2 shown by the thick wire is a map used for the warming-up demand of a catalyst.

[0065] Usually, on the map M1 sometimes used, as mentioned above, when a charge is about 60 [%], the amount spchg of charge-and-discharge amendments is 0 [kw]. And when a charge is lower than about 60 [%], if the amount spchg of charge-and-discharge amendments serves as forward (charge demand) and becomes low from S1 [%] further, the amount spchg of charge-and-discharge amendments is fixed [the amount] at W1 [kw]. On the contrary, when high, if the amount spchg of charge-and-discharge amendments serves as negative (discharge demand) and becomes high from S3 [%] further, the amount spchg of charge-and-discharge amendments is fixed [the amount] at W2 [kw].

[0066] On the other hand, S2 [%] with a charge higher than 60 [%] on the map M2 used for the warming-up demand of a catalyst has the fixed amount spchg of charge-and-discharge amendments at W1 [kw]. And if a charge becomes still higher than S2 [%], the amount spchg of charge-and-discharge amendments will become low gradually, and if S4 [%] is exceeded, the amount spchg of charge-and-discharge amendments is 0. Therefore, in the case of the map M2 for warming-up demands, in the range where a charge is higher than S1 [%], the amount spchg of charge-and-discharge amendments is always high as compared with the case of the ** map M1 at the time of usual. That is, the warming-up demand of a catalyst will usually be required to output more power from an engine 150 as compared with the time, when a charge is in the above-mentioned range.

[0067] Then, HVECU190 judges first whether the warming-up demand flag from HVECU190 is set in advance of processing of step S212 (step S206). And the map M2 for warming-up demands which the warming-up demand flag showed to drawing 4 among two kinds of amount calculation maps of charge-and-discharge amendments on which HVECU190 is memorized by internal ROM as a thing with a warming-up demand of a catalyst at the time of set **** is chosen (step S208). On the contrary, when the warming-up demand flag is not set, the ** map M1 is chosen as a thing without a warming-up demand of a catalyst at the time of usual (step S210).

[0068] And in case HVECU190 draws the amount spchg of charge-and-discharge amendments from a dc-battery 194, he is trying to use the selected amount calculation map of charge-and-discharge amendments for it at step S212.

[0069] Next, HVECU190 performs various guard processings about the base demand power spv computed at step S212 (step S214), and restricts demand power within the limits of predetermined. For example, guard processing, cell charge-and-discharge marginal guard processing based on the operating state of a dc-battery 194, rate limiter processing for transient torque characteristic reservation of an engine 150, bound guard processing based on the use limit range of an engine 150, etc. are performed one by one at the time of the abnormalities in a generator based on the transmission **** limit guard processing based on the use limit range of transmission, failure of a motor MG 1, etc.

[0070] Then, HVECU190 determines the demand power which was restricted by various guard processings and was finally drawn as last demand power spe to an engine 150 (step S216). And HVECU190 transmits and tells the determined demand power spe to ENGECU170 (step S218).

[0071] It returns to drawing 2 , and in ENGECU170, the demand power spe transmitted from HVECU190 is received (step S112), and it asks for target opening SVP* of the throttle valve 261 by the actuator 262 based on the demand power spe, respectively (step S114).

[0072] Specifically, it can ask for target opening SVP* of a throttle valve 261 as follows from the demand power spe to an engine 150. That is, ENGECU170 asks for demand torque te* of an engine 150 from the sensor (not shown) which detects the engine speed of a crankshaft 156 by asking for the engine speed ne of an engine 150 independently, and doing the division of the demand power spe to an engine 150 at the engine speed ne of an engine 150. And in case the demand torque te* is made to actually output from an engine 150, it asks for the opening SVP of the required throttle valve 261. In this way, opening SVP of the throttle valve 261 for which it asked is made into target opening SVP*.

[0073] In addition, in fact, it asks for the opening of the desired throttle valve 261 beforehand, and he memorizes them respectively as a map for target opening calculation in ROM (not shown) in the interior of ENGECU170 about each engine speed and power of an engine 150, and is trying to ask for target opening SVP* from these maps from the demand power spe to the engine speed ne of an engine 150 and engine 150 which were obtained.

[0074] Next, based on target opening SVP* of the throttle valve 261 for which it asked as mentioned above, ENGECU170 controls an actuator 262 so that the actual opening SVP of a throttle valve 261 becomes target opening SVP* (step S118). The opening SVP of a throttle valve 261 will be adjusted by this, and power almost equal to the above-mentioned demand power spe will be outputted from an engine 150.

[0075] Therefore, following operations and effectiveness are expectable by performing the above

control manipulation routines. namely, when the temperature of the catalyst 206 in an exhaust emission control device 204 is low and warming up of a catalyst needs to be performed In order that ENGECU170 may set a warming-up demand flag and HVECU190 may choose the map M2 for warming-up demands by that cause as an amount calculation map of charge-and-discharge amendments at the time of drawing the amount spchg of charge-and-discharge amendments, As demand power spe to an engine 150, much power will usually be set up rather than the time. Since the opening SVP of a throttle valve 261 is adjusted so that power almost equal to that demand power spe may be outputted from an engine 150 at this time, as for that opening SVP, much power usually becomes greatly compared with the time so that may be outputted from an engine 150, and it can secure enough the amount of the exhaust gas discharged from an engine 150 as that result. Therefore, since a moderate quantity of exhaust gas flows in an exhaust emission control device 204 through an exhaust pipe 202, with the exhaust gas warmed moderately, the temperature of a catalyst 206 can fully be raised and warming up of the optimal catalyst can be performed.

[0076] Moreover, it is changed into power in the motor MG 1 which the power is transmitted to a motor MG 1 through planetary gear 120 although more power will be outputted [in case warming up of a catalyst is performed in this way / engine / 150 / usually / the time], and functions as a generator, and a dc-battery 194 charges. That is, more power of the amount spchg of charge-and-discharge amendments in the map M2 for warming-up demands shown in the dc-battery 194 at drawing 4 and the amount which is equivalent to difference with the amount spchg of charge-and-discharge amendments in the ** map M1 at the time of usual will usually be charged compared with the time. Therefore, since the fuel supplied to the engine 150 is changed into power through power and stored in a dc-battery 194 without futility, it can prevent aggravation of fuel consumption.

[0077] Moreover, in case warming up of a catalyst is performed, the opening SVP of a throttle valve 261 is adjusted, and since it will be controlled so that much power is outputted from an engine 150, as compared with the case where ignition lag control which was used with the conventional technique is performed, fuel consumption can be raised also in this point.

[0078] Moreover, after performing warming up of a catalyst, in order for a dc-battery 194 to mean that more power was usually charged as compared with the time, the charge is usually higher than the time at it. Therefore, if the power of a part which became high [this charge] is used, since that part and the transit (EV transit) using [it is more long and] a motor MG 2 etc. will be attained, even when it is total, it is useful to improvement in fuel consumption.

[0079] In addition to catalyst 206, when warming up of a catalyst is performed, since engine 150 body can also perform warming up at an early stage, during car transit, it can begin the on-off operation of an engine 150 early more, and can aim at improvement in fuel consumption also at this point further again.

[0080] In addition, as a configuration of the power output unit which applies this invention, various configurations besides the configuration shown in drawing 1 are possible. In drawing 1 , although the motor MG 2 is combined with the ring wheel shaft 126, the configuration combined with the planetary carrier shaft 127 which the motor MG 2 linked with the crankshaft 156 of an engine 150 directly can also be taken. The configuration as the 1st modification is shown in drawing 5 . In drawing 5 , the integrated state to the planetary gear 120 of an engine 150 and motors MG1 and MG2 is different from the example of drawing 1 . It is the same as drawing 1 at the point that a motor MG 1 is combined with the sun gear shaft 125 in connection with planetary gear 120, and the crankshaft 156 of an engine 150 is combined with the planetary carrier shaft 127. In drawing 5 , a motor MG 2 is different from the example of drawing 1 at the point combined with the planetary carrier shaft 127 instead of the ring wheel shaft 126.

[0081] Also in this configuration, by driving the motor MG 2 combined with the planetary carrier shaft 127, for example using the power revived by the motor MG 1, the further torque can be added to the planetary carrier shaft 127 linking directly to a crankshaft 156, and this torque addition is performed so that demand torque may be outputted to a driving shaft 112. Therefore, since the power outputted from the engine 150 by adjusting the power exchanged in the form of power through motors MG1 and MG2 like the example of drawing 1 can be outputted from a

driving shaft 112 as a desired engine speed and torque, the operating point is chosen freely and an engine 150 can be operated. Therefore, it is possible to apply this invention also to such a configuration.

[0082] Moreover, this invention is also applicable to the power output unit of another configuration. The configuration as the 2nd modification is shown in drawing 6 R> 6. In the above-mentioned example and the 1st above-mentioned modification, the electric distribution mold power adjusting device which used the motor for Rota etc. is used as a power adjusting device in this 2nd modification to having used the machine distribution mold power adjusting device using the planetary-gear 120 grade as a power adjusting device for transmitting a part of power outputted from the engine 150 to a driving shaft 112. With this power output unit, it replaces with planetary gear 120 and a motor MG 1, and, specifically, has the clutch motor CM. A clutch motor is a motor for Rota relatively equipped with the pivotable inner rotor 302 and a pivotable outer rotor 304. The inner rotor 302 is combined with the crankshaft 156 of an engine 150, and the outer rotor 304 is combined with the driving shaft 112 as shown in drawing 6 . Power is supplied to an outer rotor 304 through the slip ring 306. The motor MG 2 is combined with the shaft by the side of an outer rotor 304. Other configurations are the same as the configuration shown by drawing 1 .

[0083] The power outputted from the engine 150 can be transmitted to a driving shaft 112 through the clutch motor CM. The clutch motor CM transmits power through electromagnetic association between the inner rotor 302 and an outer rotor 304. Under the present circumstances, if the rotational frequency of an outer rotor 304 is lower than the rotational frequency of the inner rotor 302, the power according to both slipping can be revived by the clutch motor CM. On the contrary, if power is supplied to the clutch motor CM, the rotational frequency of the inner rotor 302 can be accelerated and it can output to a driving shaft 112. Torque can be compensated with a motor MG 2 when not in agreement with the demand torque which the torque outputted through the clutch motor CM from the engine 150 should output from a driving shaft 112.

[0084] The role of a motor MG 2 is the same as the case of the example shown in drawing 1 . Therefore, this invention is applicable also to the 2nd modification.

[0085] In addition, this invention can be carried out in various modes in the range which is not restricted to the above-mentioned example or the above-mentioned operation gestalt, and does not deviate from the summary.

[0086] That is, in the above-mentioned example and the above-mentioned modification, although the case where this invention was applied to the car of a parallel hybrid system was explained, it is also possible to apply this invention to the car of a series hybrid method. Also in a series hybrid method, it is because the power outputted from the engine can be outputted to a driving shaft with the engine speed and torque of arbitration, so an engine can choose the operating point freely and can be operated.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the outline configuration of the hybrid car as one example of this invention.
[Drawing 2] In the example of drawing 1 , it is the flow chart which shows the flow of the control manipulation routine by ENGECU170 among the control processings in connection with catalyst warming up.
[Drawing 3] In the example of drawing 1 , it is the flow chart which shows the flow of the control manipulation routine by HVECU190 among the control processings in connection with catalyst warming up.
[Drawing 4] It is the explanatory view showing the amount calculation map of charge-and-discharge amendments used in the example of drawing 1 .
[Drawing 5] It is the block diagram showing the outline configuration of the hybrid car which carried the power output unit of ** as the 1st modification of this invention.
[Drawing 6] It is the block diagram showing the outline configuration of the hybrid car which carried the power output unit of ** as the 2nd modification of this invention.
[Description of Notations]
110 -- Power output unit
111 -- Power transfer gear
112 -- Driving shaft
113 -- Power receipt gear
114 -- Differential gear
116 -- Driving wheel
119 -- Case
120 -- Planetary gear
121 -- Sun gear
122 -- Ring wheel
123 -- Planetary pinion gear
124 -- Planetary carrier
125 -- Sun gear shaft
126 -- Ring wheel shaft
127 -- Planetary carrier shaft
128 -- Power fetch gear
129 -- Chain belt
130 -- Damper
132 -- Rota
133 -- Stator
142 -- Rota
143 -- Stator
150 -- Engine
151 -- Fuel injection valve
152 -- Combustion chamber

153 -- Inlet valve
154 -- Piston
156 -- Crankshaft
157 -- VVT
158 -- Ignitor
160 -- Distributor
162 -- Ignition plug
164 -- Accelerator pedal
164a -- Accelerator pedal position sensor
165 -- Air-conditioner sensor
170 -- ENGECU
174 -- Coolant temperature sensor
176 -- Rotational frequency sensor
178 -- Angle-of-rotation sensor
179 -- Start switch
190 -- HVECU
191,192 -- Drive circuit
194 -- Dc-battery
199 -- Charge detector
200 -- Inhalation opening
202 -- Exhaust pipe
204 -- Exhaust emission control device
206 -- Catalyst
261 -- Throttle valve
262 -- Actuator
263 -- Throttle-valve position sensor
264 -- Cam-shaft position sensor
302 -- Inner rotor
304 -- Outer rotor
306 -- Slip ring
CM -- Clutch motor
M1 -- It is the ** map at the time of usual.
M2 -- Map for warming-up demands
MG1 -- Motor
MG2 -- Motor

[Translation done.]